Operating Instructions

VEGAPULS 65

4 … 20 mA/HART - two-wire

Document ID: 28437

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Supplementary documentation

Information:
Supplementary documents appropriate to the ordered version come with the delivery. You can find them listed in chapter "*Product description*".

Instructions manuals for accessories and replacement parts

Tip:
To ensure reliable setup and operation of your VEGAPULS 65, we offer accessories and replacement parts. The corresponding documentations are:

- 27835 - Display and adjustment module PLICSCOM
- 32628 - Interface adapter VEGACONNECT
- 43814 - Externe Anzeige VEGADIS 81
- 34296 - Protective cover
- 30176 - Electronics module VEGAPULS series 60
- 31088 - Flanges according to DIN-EN-ASME-JIS

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1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup as well as important instructions for maintenance and fault rectification. Please read this information before putting the instrument into operation and keep this manual accessible in the immediate vicinity of the device.

1.2 Target group

This operating instructions manual is directed to trained specialist personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbols used

Information, tip, note
This symbol indicates helpful additional information.

Caution: If this warning is ignored, faults or malfunctions can result.

Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.

Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.

Ex applications
This symbol indicates special instructions for Ex applications.

SIL applications
This symbol indicates instructions for functional safety which must be taken into account particularly for safety-relevant applications.

- **List**
  The dot set in front indicates a list with no implied sequence.

→ **Action**
This arrow indicates a single action.

1 **Sequence of actions**
Numbers set in front indicate successive steps in a procedure.

Battery disposal
This symbol indicates special information about the disposal of batteries and accumulators.

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2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained specialist personnel authorised by the plant operator.

During work on and with the device the required personal protective equipment must always be worn.

2.2 Appropriate use

VEGAPULS 65 is a sensor for continuous level measurement.

You can find detailed information about the area of application in chapter "*Product description*".

Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions manual as well as possible supplementary instructions.

For safety and warranty reasons, any invasive work on the device beyond that described in the operating instructions manual may be carried out only by personnel authorised by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden.

2.3 Warning about incorrect use

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

This is a high-tech instrument requiring the strict observance of standard regulations and guidelines. The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards as well as all prevailing safety regulations and accident prevention rules.

Depending on the model, the emitting frequencies of all radar sensors are either in the C or K band range. The low transmitting power lies far below the internationally permitted limit values. When the instrument is used correctly, it presents no danger to human health. It may be operated without restriction outside of closed metallic vessels.

The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for trouble-free operation of the instrument.

During the entire duration of use, the user is obliged to determine the compliance of the necessary occupational safety measures with the current valid rules and regulations and also take note of new regulations.

2.5 Safety label on the instrument

The safety approval markings and safety tips on the device must be observed.

2.6 CE conformity

The device fulfills the legal requirements of the applicable EC guidelines. By affixing the CE marking, we confirm successful testing of the product.

You can find the CE Certificate of Conformity in the download section of our homepage.

2.7 Fulfillment of NAMUR recommendations

NAMUR is the automation technology user association in the process industry in Germany. The published NAMUR recommendations are accepted as the standard in field instrumentation.

The device fulfills the requirements of the following NAMUR recommendations:

- NE 21 – Electromagnetic compatibility of equipment
- NE 43 – Signal level for malfunction information from measuring transducers
- NE 53 – Compatibility of field devices and display/adjustment components

For further information see www.namur.de.

2.8 FCC and IC conformity (only for USA/Canada)

VEGAPULS 65 is FCC and IC approved:

- FCC ID: O6QPULS6566
- IC: 3892A-PS6566

Modifications not expressly approved by VEGA will lead to expiry of the operating licence according to FCC.

VEGAPULS 65 is in conformity with part 15 of the FCC regulations. Take note of the respective operating regulations:

- The instrument must not cause any interfering emissions
- The device must be insensitive to interfering immissions, including those that may cause undesirable operating conditions

The instrument was tested and meets the limit values for a digital instrument of class B, according to part 15 of the FCC regulations. The limit values are predefined to ensure protection against interfering emissions during operation in industrial environments.

The instrument can generate, use and emit high frequency energy and can generate interfering emissions if not used as described in the operator's manual. Because interfering emissions have to be reckoned with when the instrument is used in residential areas, the user must make sure necessary countermeasures are implemented.

2.9 Safety instructions for Ex areas

Please note the Ex-specific safety information for installation and operation in Ex areas. These safety instructions are part of the operating instructions manual and come with the Ex-approved instruments.

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2.10 Environmental instructions

Protection of the environment is one of our most important duties. That is why we have introduced an environment management system with the goal of continuously improving company environmental protection. The environment management system is certified according to DIN EN ISO 14001.

Please help us fulfill this obligation by observing the environmental instructions in this manual:

- Chapter "*Packaging, transport and storage*"
- Chapter "*Disposal*"

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- VEGAPULS 65 radar sensor
- Documentation
  - this operating instructions manual
  - Safety Manual 31338 "*VEGAPULS series 60 - 4 … 20 mA/HART*" (optionally)
  - Operating instructions manual - 27835 "*Display and adjustment module PLICSCOM*" (optional)
  - Supplementary instructions manual - 31708 "*Heating for display and adjustment module*" (optional)
  - Supplementary instructions manual "*Plug connector for continuously measuring sensors*" (optional)
  - Ex-specific "*Safety instructions*" (with Ex versions)
  - if necessary, further certificates

Constituent parts

The VEGAPULS 65 consists of the components:

- Process fitting with antenna system
- Housing with electronics, optionally available with plug connector, optionally available with connection cable
- Housing cover, optionally available with display and adjustment module PLICSCOM

The components are available in different versions.

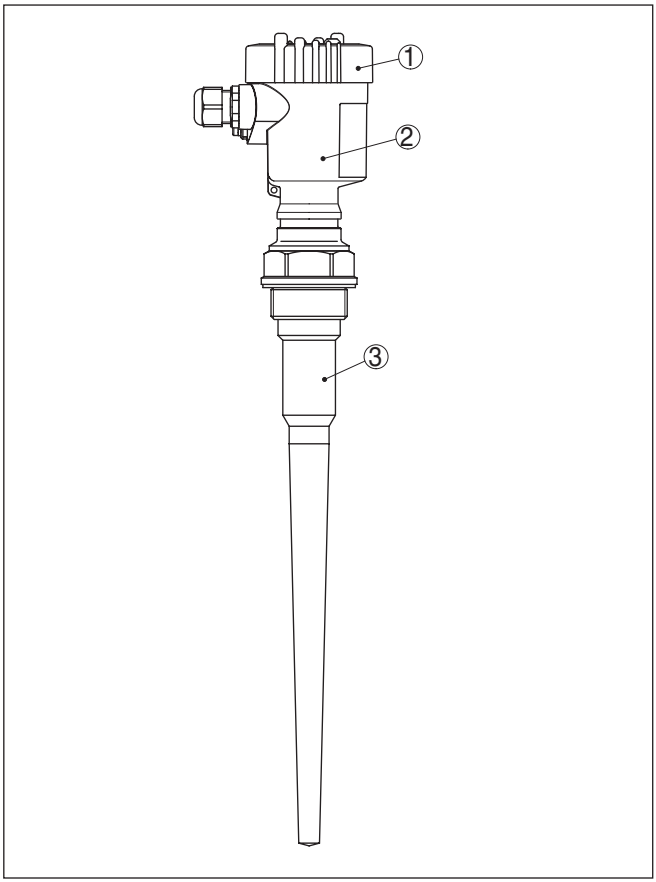

Fig. 1: VEGAPULS 65 - threaded version with plastic housing

1 Housing cover with integrated PLICSCOM (optional)
2 Housing with electronics
3 Process fitting with antenna system

Type label

The type label contains the most important data for identification and use of the instrument:

- Instrument type
- Article and serial number device
- Article numbers, documentation
- Technical data: Approvals, antenna type, process fitting, process seal/temperature, signal output, voltage supply, protection, protection class
- SIL identification (with SIL rating ex works)

With the serial number, you can access the delivery data of the instrument via www.vega.com, "*VEGA Tools*" and "*serial number search*".

You can find the serial number on the inside of the instrument as well as on the type label on the outside.

Scope of this operating instructions manual

This operating instructions manual applies to the following instrument versions:

- Hardware version < 2.0.0
- Software version ≤ 3.8

3.2 Principle of operation

Area of application

VEGAPULS 65 is a radar sensor in C-band technology (emitting frequency approx. 6 GHz) for continuous level measurement. It is particularly suitable for vessels with small process fitting that contain corrosive liquids under simple to difficult process conditions.

Functional principle

The antenna of the radar sensor emits short radar pulses with a duration of approx. 1 ns. These pulses are reflected by the product and received by the antenna as echoes. The transit time of the radar pulses from emission to reception is proportional to the distance and hence to the level. The determined level is converted into an appropriate output signal and outputted as measured value.

Voltage supply

4 … 20 mA/HART two-wire electronics for voltage supply and measured value transmission on the same cable.

The supply voltage range can differ depending on the instrument version.

The data for power supply are specified in chapter "*Technical data*".

The optional background lighting of the display and adjustment module is powered by the sensor. A certain level of operating voltage is required for this. You can find the exact voltage specifications in chapter "*Technical data*".

The optional heating requires its own operating voltage. You can find details in the supplementary instructions manual "*Heating for display and adjustment module*".

This function is generally not available for approved instruments.

3.3 Operation

The instrument can be adjusted with the following adjustment media:

- With the display and adjustment module
- with the suitable VEGA DTM in conjunction with an adjustment software according to the FDT/DTM standard, e.g. PACTware and PC
- with manufacturer-specific adjustment programs AMS™ or PDM
- With a HART handheld

3.4 Packaging, transport and storage

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test based on ISO 4180.

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The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Transport

Transport must be carried out in due consideration of the notes on the transport packaging. Nonobservance of these instructions can cause damage to the device.

Transport inspection

The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with.

Storage

Up to the time of installation, the packages must be left closed and stored according to the orientation and storage markings on the outside.

Unless otherwise indicated, the packages must be stored only under the following conditions:

- Not in the open
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration

Storage and transport temperature

- Storage and transport temperature see chapter "*Supplement - Technical data - Ambient conditions*"
- Relative humidity 20 … 85 %

4 Mounting

4.1 General instructions

Installation position

Select an installation position you can easily reach for mounting and connecting as well as later retrofitting of a display and adjustment module. The housing can be rotated by 330° without the use of any tools. You can also install the display and adjustment module in four different positions (each displaced by 90°).

Screwing in

Warning:
With threaded versions, the housing must not be used to screw in the instrument! Applying tightening forces on the housing can damage its internal parts.

Moisture

Use the recommended cables (see chapter "*Connecting to power supply*") and tighten the cable gland.

You can give your instrument additional protection against moisture penetration by leading the connection cable downward in front of the cable entry. Rain and condensation water can thus drain off. This applies mainly to outdoor mounting as well as installation in areas where high humidity is expected (e.g. through cleaning processes) or on cooled or heated vessels.

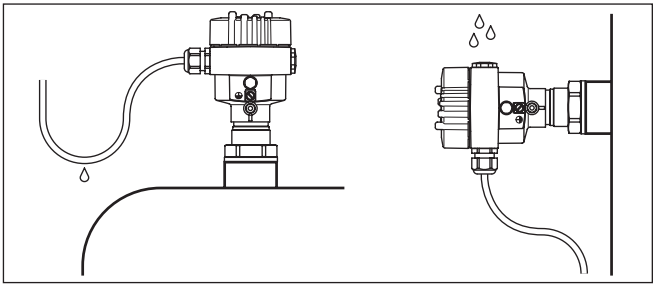

Fig. 2: Measures against moisture ingress

Measuring range

The reference plane for the measuring range of the sensors is the lower edge of the flange or the seal surface of the thread.

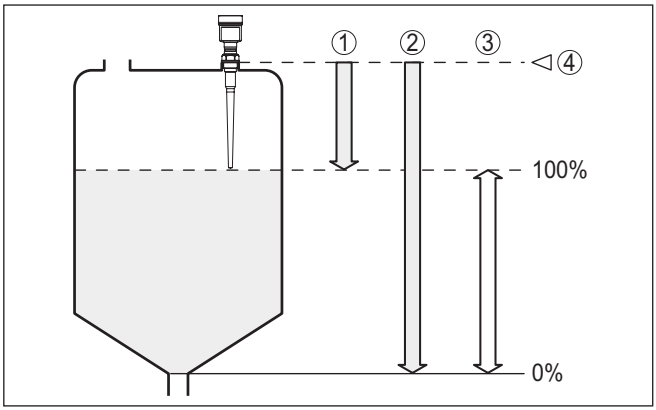

Fig. 3: Measuring range (operating range) and max. measuring distance

1 full
2 empty (max. measuring distance)
3 Measuring range

Information:
If the medium reaches the antenna, buildup can form on it and cause faulty measurements later on.

Polarisation plane

The emitted radar impulses of VEGAPULS 65 are electromagnetic waves. The polarisation plane is the direction of the electrical share. Their position is marked on the instrument.

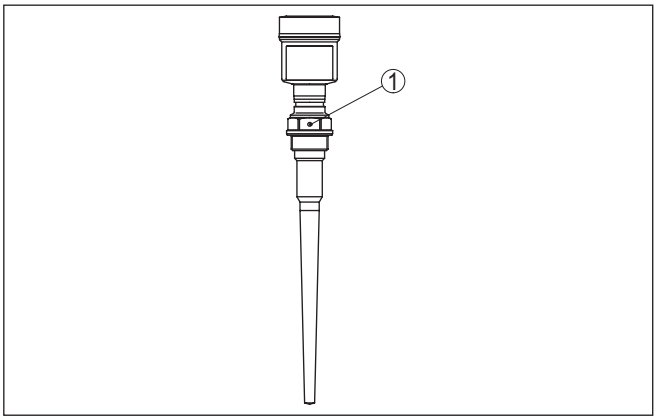

Fig. 4: Position of the polarisation plane of VEGAPULS 65

1 Marking hole

Suitability for the process conditions

Make sure that all parts of the instrument coming in direct contact with the process, especially the sensor element, process seal and process fitting, are suitable for the existing process conditions, such

as process pressure, process temperature as well as the chemical properties of the medium.

You can find the specifications in chapter "*Technical data*" and on the nameplate.

4.2 Mounting instructions

Mounting of instruments with PTFE-coated flanges

The flange screws of VEGAPULS 65 must be always screwed with the torque stated in the technical data so that the PTFE washer of the encapsulated antenna system seals.

You can counteract the material-induced tension loss with PTFE by doing the following:

1. Make sure the number of flange screws corresponds to the number of flange holes
2. Use disc springs in addition to the flange screws for fastening the flange
3. Tighten the screws steadily with the torque specified in the technical data

Installation position

When mounting the VEGAPULS 65, keep a distance of at least 500 mm (19.69 in) to the vessel wall. If the sensor is installed in the center of dished or round vessel tops, multiple echoes can arise. These can, however, be suppressed by an appropriate adjustment (see chapter "*Setup*").

If you cannot maintain this distance, you should carry out a false signal storage during setup. This applies particularly if buildup on the vessel wall is expected. In such cases, we recommend repeating the false signal storage at a later date with existing buildup.

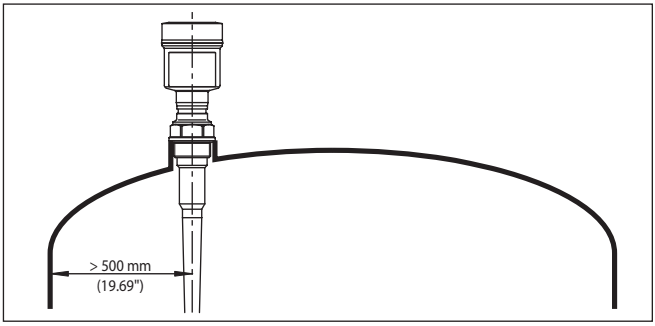

Fig. 5: Mounting on round vessel tops

1 Reference plane
2 Vessel center or symmetry axis

In vessels with conical bottom it can be advantageous to mount the sensor in the center of the vessel, as measurement is then possible down to the lowest point of the vessel bottom.

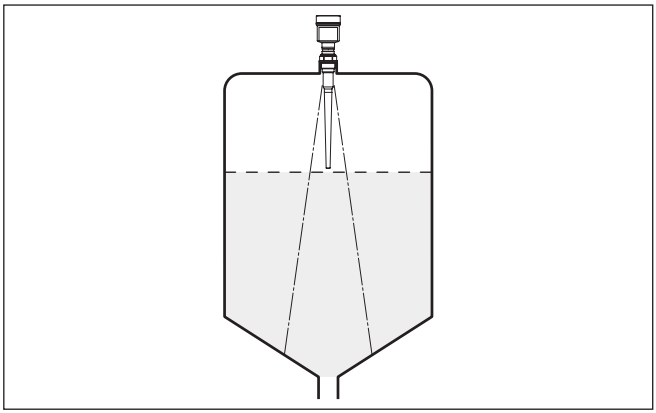

Fig. 6: Vessel with conical bottom

Inflowing medium

Do not mount the instruments in or above the filling stream. Make sure that you detect the product surface, not the inflowing product.

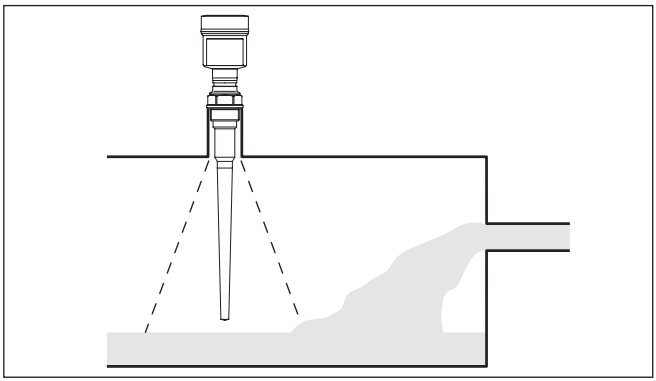

Fig. 7: Inflowing liquid

Socket

The active part of the antenna, i.e. the conical antenna part should protrude completely out of the socket.

To meet the different socket dimensions, sensors for socket lengths up to 50, 100 and 250 mm (2, 4, 10 in) are available.

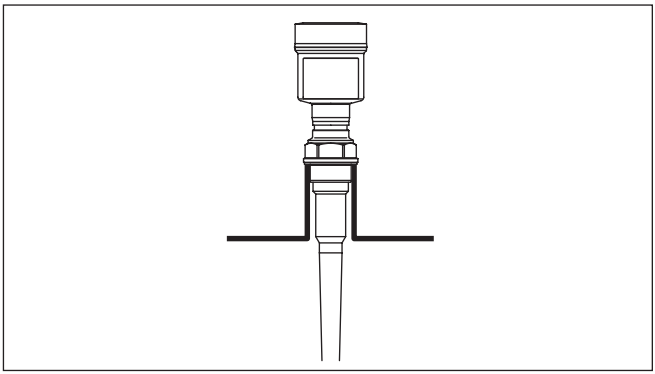

Fig. 8: Recommended socket mounting

In case of very big socket diameters, the active antenna part can be slightly recessed in the socket. The following rule applies to the standard version of VEGAPULS 65: Socket diameter corresponds to max. socket height.

Sensor orientation

In liquids, direct the sensor as perpendicular as possible to the product surface to an achieve optimum measurement.

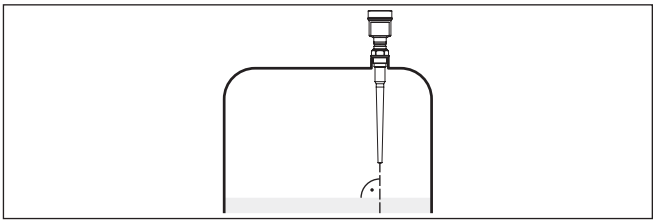

Fig. 9: Alignment in liquids

Vessel installations

The mounting location of the radar sensor should be a place where no other equipment or fixtures cross the path of the microwave signals.

Vessel installations such as for example, ladders, limit switches, heating spirals, struts etc. can cause false echoes that interfere with the useful echo. Make sure when planning your measuring site that the radar signals have a "clear view" to the measured product.

In case of existing vessel installations, a false echo storage should be carried out during setup.

If large vessel installations such as struts or supports cause false echoes, these can be attenuated through supplementary measures. Small, inclined sheet metal baffles above the installations scatter the radar signals and prevent direct interfering reflections.

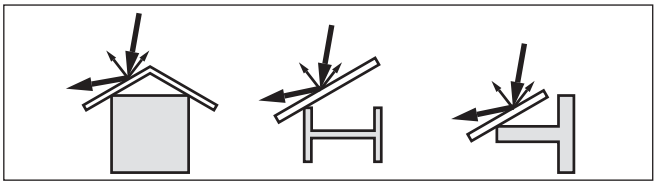

Fig. 10: Cover flat, large-area profiles with deflectors

Agitators

If there are agitators in the vessel, a false signal storage should be carried out with the agitators in motion. This ensures that the interfering reflections from the agitators are saved with the blades in different positions.

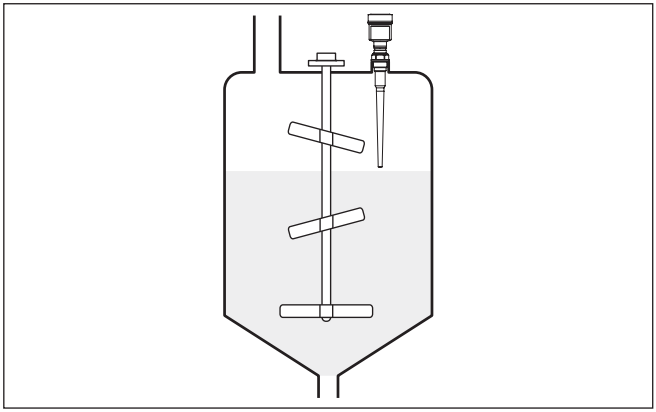

Fig. 11: Agitators

Foam generation

Through the action of filling, stirring and other processes in the vessel, dense foams which considerably damp the emitted signals may form on the product surface.

If foams are causing measurement errors, the biggest possible radar antenna should be used.

As an alternative, sensors with guided microwave can be used. These are unaffected by foam generation and are best suited for such applications.

5 Connecting to power supply

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

- Connect only in the complete absence of line voltage
- If overvoltage surges are expected, overvoltage arresters should be installed

Tip:
We recommend using VEGA overvoltage arresters B63-48 and ÜSB 62-36G.X.

In hazardous areas you must take note of the respective regulations, conformity and type approval certificates of the sensors and power supply units.

Voltage supply

Power supply and current signal are carried on the same two-wire cable. The voltage supply range can differ depending on the instrument version.

The data for power supply are specified in chapter "*Technical data*".

Provide a reliable separation between the supply circuit and the mains circuits according to DIN EN 61140 VDE 0140-1. The VEGA power supply units VEGATRENN 149A Ex, VEGASTAB 690 as well as all VEGAMETs and VEGASCANs meet this requirement.

Keep in mind the following additional factors that influence the operating voltage:

- Output voltage of the power supply unit can be lower under nominal load (with a sensor current of 20.5 mA or 22 mA in case of fault message)
- Influence of additional instruments in the circuit (see load values in chapter "*Technical data*")

Connection cable

The instrument is connected with standard two-wire cable without screen. If electromagnetic interference is expected which is above the test values of EN 61326 for industrial areas, screened cable should be used.

Use cable with round cross-section. A cable outer diameter of 5 … 9 mm (0.2 … 0.35 in) ensures the seal effect of the cable gland. If you are using cable with a different diameter or cross-section, exchange the seal or use a suitable cable gland.

We generally recommend the use of screened cable for HART multidrop mode.

Cable gland ½ NPT

On the instrument with cable entry ½ NPT and plastic housing there is a metallic ½" threaded insert moulded into the plastic housing.

Caution:
No grease should be used when screwing the NPT cable gland or steel tube into the threaded insert. Standard grease can contain additives that corrode the connection between threaded insert and

housing. This would influence the stability of the connection and the tightness of the housing.

Cable screening and grounding

If screened cable is required, connect the cable screen on both ends to ground potential. In the sensor, the screen must be connected directly to the internal ground terminal. The ground terminal on the outside of the housing must be connected to the potential equalisation (low impedance).

If potential equalisation currents are expected, the connection on the processing side must be made via a ceramic capacitor (e. g. 1 nF, 1500 V). The low-frequency potential equalisation currents are thus suppressed, but the protective effect against high frequency interference signals remains.

Warning:
Considerable potential differences exist inside galvanic plants as well as vessels with cathodic corrosion protection. Very large equalisation currents can flow through the cable screen when the screen is grounded on both ends. To avoid this, the cable screen must be connected to ground potential only on one end (inside the switching cabinet) in such applications. The cable screen must **not** be connected to the internal ground terminal in the sensor and the outer ground terminal on the housing **not** to potential equalisation!

Information:
The metallic parts of the instrument (transmitter, process fitting, etc.) are conductively connected with the inner and outer ground terminal on the housing. This connection exists either as a direct metallic contact or via the shielding of the special connection cable on instruments with external electronics. You can find specifications on the potential connections within the instrument in chapter "*Technical data*".

Take note of the corresponding installation regulations for Ex applications. In particular, make sure that no potential equalisation currents flow over the cable screen. In case of grounding on both sides this can be achieved by the use of a capacitor or a separate potential equalisation.

5.2 Connection procedure

Proceed as follows:

1. Unscrew the housing cover
2. If a display and adjustment module is installed, remove it by turning it to the left.
3. Loosen compression nut of the cable entry gland
4. Remove approx. 10 cm (4 in) of the cable mantle, strip approx. 1 cm (0.4 in) of insulation from the ends of the individual wires
5. Insert the cable into the sensor through the cable entry
6. Lift the opening levers of the terminals with a screwdriver (see following illustration)

7. Insert the wire ends into the open terminals according to the wiring plan

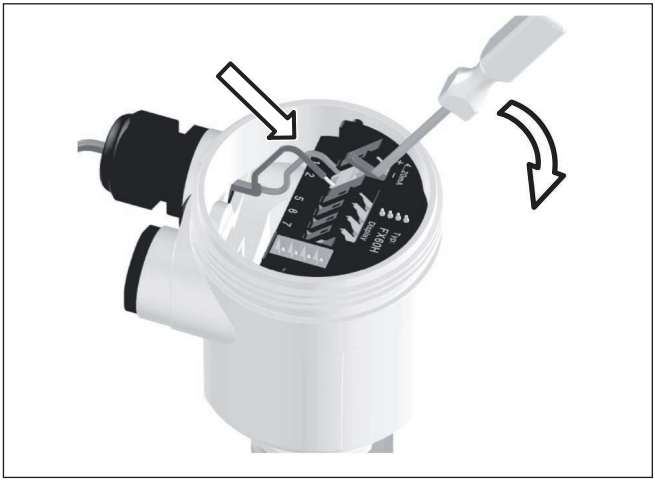

Fig. 12: Connection steps 6 and 7

8. Press down the opening levers of the terminals, you will hear the terminal spring closing
9. Check the hold of the wires in the terminals by lightly pulling on them
10. Connect the screen to the internal ground terminal, connect the outer ground terminal to potential equalisation
11. Tighten the compression nut of the cable entry gland. The seal ring must completely encircle the cable
12. Screw the housing lid back on

The electrical connection is finished.

5.3 Wiring plan, single chamber housing

The following illustrations apply to the non-Ex as well as to the Ex-ia version.

Housing overview

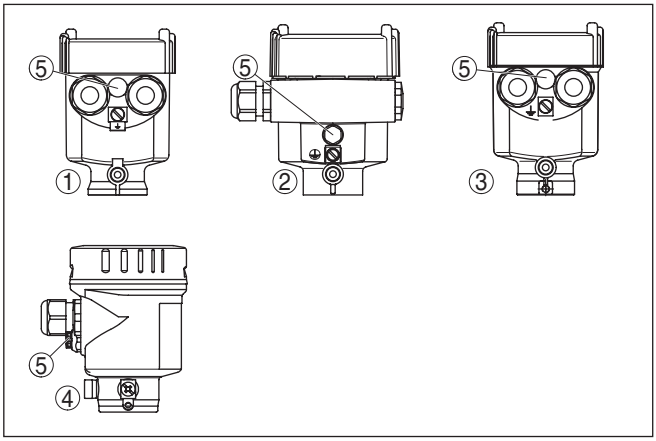

Fig. 13: Material versions, single chamber housing

1 *Plastic*
2 *Aluminium*
3 *Stainless steel, precision casting*
4 *Stainless steel, electro-polished*
5 *Filter element for air pressure compensation of all material versions. Blind plug with version IP 66/IP 68, 1 bar for Aluminium and stainless steel*

Electronics and terminal compartment

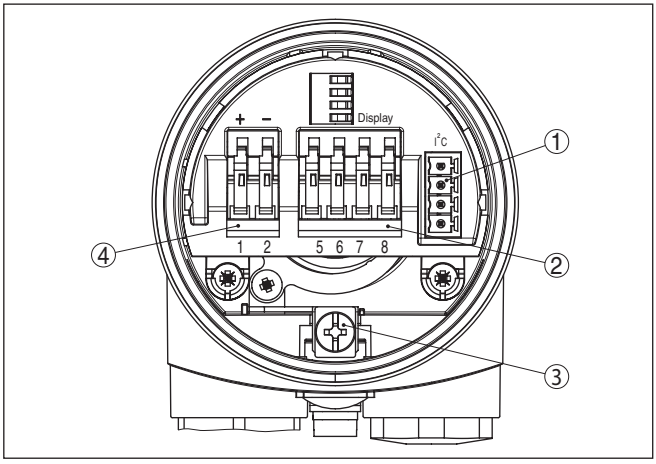

Fig. 14: Electronics and terminal compartment, single chamber housing

1 *Plug connector for VEGACONNECT (I^2C interface)*
2 *Spring-loaded terminals for connection of the external indication VEGADIS 61*
3 *Ground terminal for connection of the cable screen*
4 *Spring-loaded terminals for voltage supply*

Wiring plan

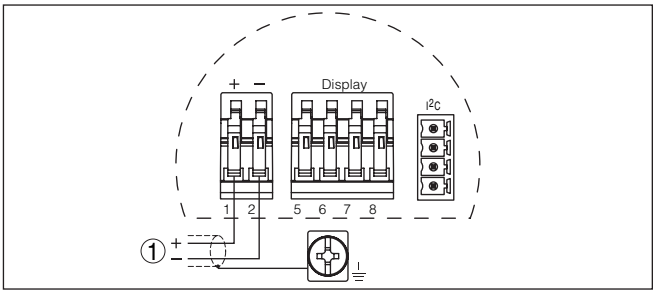

Fig. 15: Wiring plan, single chamber housing

1 Voltage supply, signal output

5.4 Wiring plan, double chamber housing

The following illustration apply to non-Ex as well as Ex ia versions. The Exd version is described in the next subchapter.

Housing overview

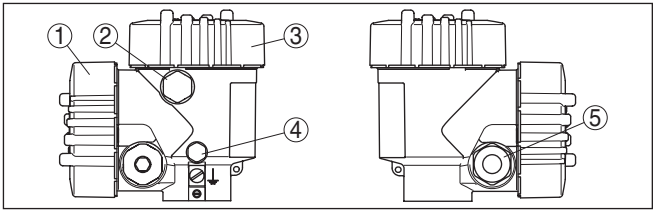

Fig. 16: Double chamber housing

1 Housing cover, connection compartment
2 Blind plug or plug M12 x 1 for VEGADIS 61 (optional)
3 Housing cover, electronics compartment
4 Filter element for air pressure compensation
5 Cable gland

Electronics compartment

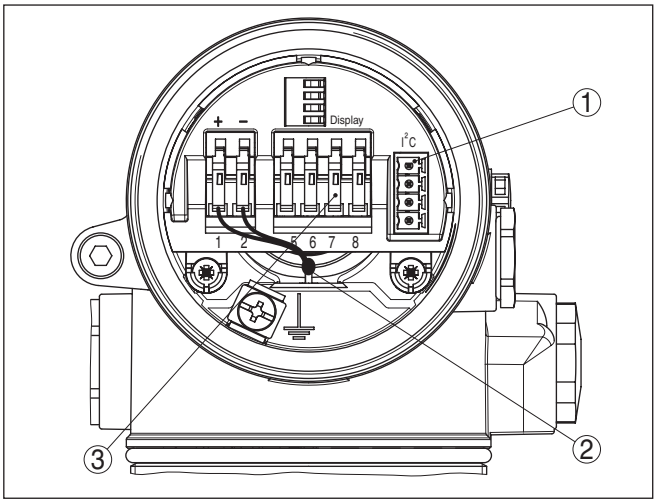

Fig. 17: Electronics compartment, double chamber housing

1 Plug connector for VEGACONNECT (I^2C interface)
2 Internal connection cable to the connection compartment
3 Terminals for VEGADIS 81

Terminal compartment

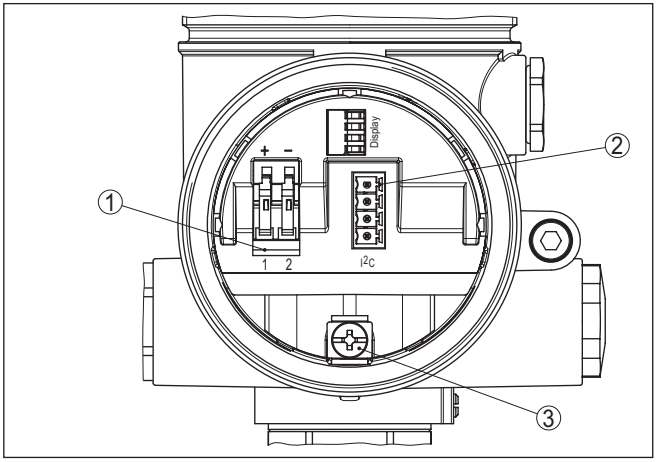

Fig. 18: Terminal compartment, double chamber housing

1 Spring-loaded terminals for voltage supply
2 Plug connector for VEGACONNECT (I^2C interface)
3 Ground terminal for connection of the cable screen

Wiring plan

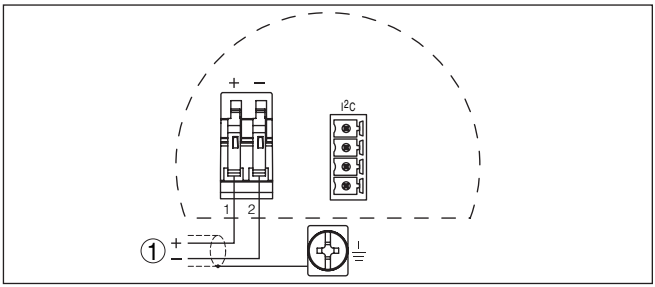

Fig. 19: Wiring plan, double chamber housing

1 Voltage supply, signal output

5.5 Wiring plan, double chamber housing Ex d

Housing overview

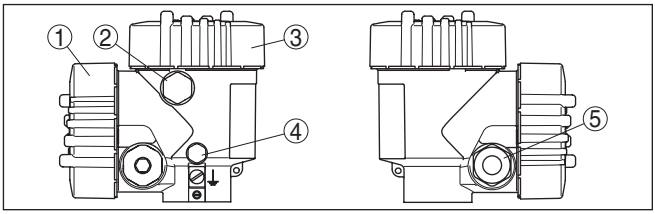

Fig. 20: Double chamber housing

1 Housing cover, connection compartment
2 Blind plug or plug M12 x 1 for VEGADIS 61 (optional)
3 Housing cover, electronics compartment
4 Filter element for air pressure compensation
5 Cable gland

Electronics compartment

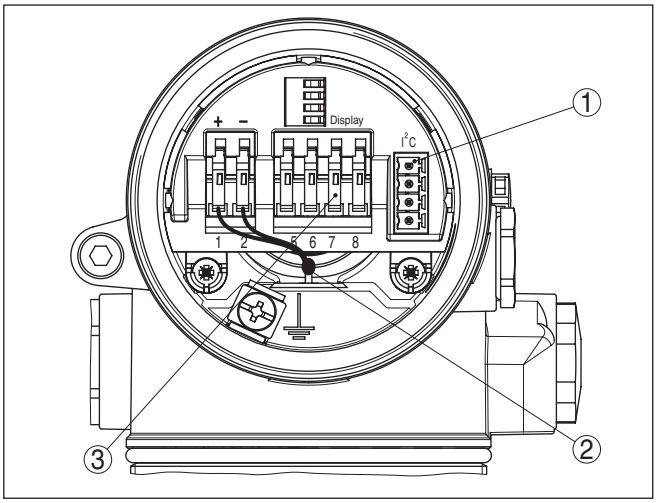

Fig. 21: Electronics compartment, double chamber housing

1 Plug connector for VEGACONNECT (I^2C interface)
2 Internal connection cable to the connection compartment
3 Terminals for VEGADIS 81

Terminal compartment

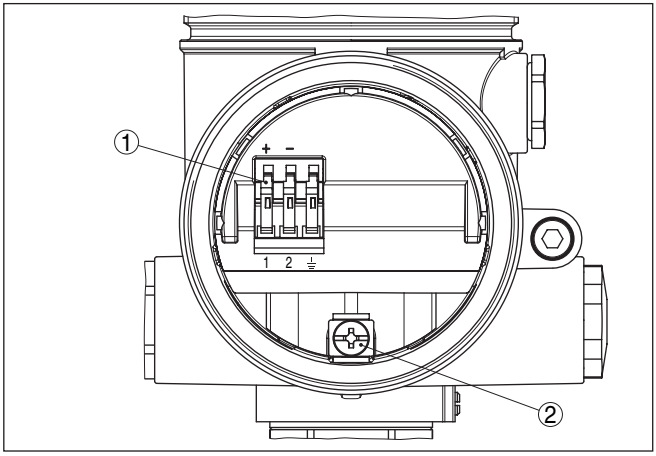

Fig. 22: Connection compartment, Ex-d-ia double chamber housing

1 Spring-loaded terminals for power supply and cable screen
2 Ground terminal for connection of the cable screen

Wiring plan

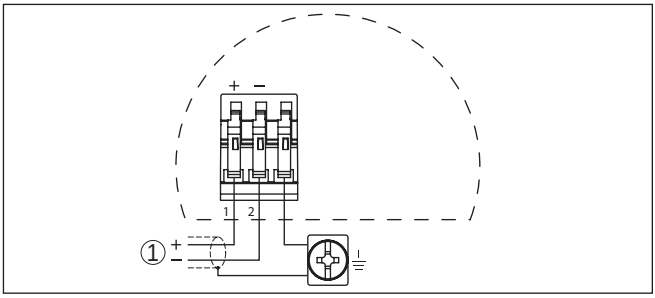

Fig. 23: Wiring plan, Ex-d-ia double chamber housing

1 Voltage supply, signal output

5.6 Wiring plan - version IP 66/IP 68, 1 bar

Wire assignment, connection cable

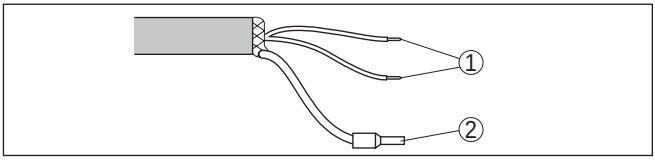

Fig. 24: Wire assignment, connection cable

1 brown (+) and blue (-) to power supply or to the processing system
2 Shielding

5.7 Switch-on phase

Switch-on phase

After connecting VEGAPULS 65 to power supply or after a voltage recurrence, the instrument carries out a self-check for approx. 30 seconds:

- Internal check of the electronics
- Indication of the instrument type, the firmware as well as the sensor TAGs (sensor designation)
- Output signal jumps briefly (approx. 10 seconds) to the set fault current

Then the corresponding current is outputted to the cable (the value corresponds to the actual level as well as the settings already carried out, e.g. factory setting).

6 Set up with the display and adjustment module PLICSCOM

6.1 Short description

Function/Configuration

The display and adjustment module is used for measured value display, adjustment and diagnosis. It can be mounted in the following housing versions and instruments:

- All continuously measuring sensors in single as well as double chamber housing (optionally in the electronics or connection compartment)
- External display and adjustment unit

Note:
You can find detailed information on adjustment in the operating instructions manual "*Display and adjustment module*".

6.2 Insert display and adjustment module

Mount/Dismount display and adjustment module

The display and adjustment module can be inserted into the sensor and removed again at any time. It is not necessary to interrupt the power supply.

Proceed as follows:

1. Unscrew the housing cover
2. Place the display and adjustment module in the desired position on the electronics (you can choose any one of four different positions - each displaced by 90°)
3. Press the display and adjustment module onto the electronics and turn it to the right until it snaps in.
4. Screw housing cover with inspection window tightly back on

Disassembly is carried out in reverse order.

The display and adjustment module is powered by the sensor, an additional connection is not necessary.

Fig. 25: Insert display and adjustment module

Note:
If you intend to retrofit the instrument with a display and adjustment module for continuous measured value indication, a higher cover with an inspection glass is required.

6.3 Adjustment system

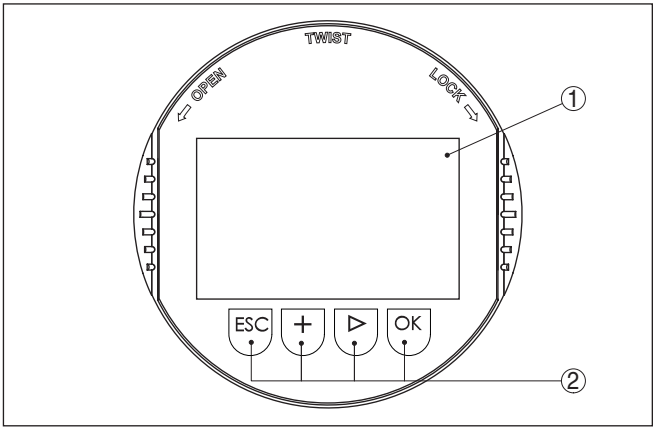

Fig. 26: Display and adjustment elements

1 LC display
2 Indication of the menu item number
3 Adjustment keys

Key functions

- ***[OK]*** key:

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- Move to the menu overview
- Confirm selected menu
- Edit parameter
- Save value

- ***[->]*** key to select:
  - Menu change
  - Select list entry
  - Select editing position

- ***[+]*** key:
  - Change value of the parameter

- ***[ESC]*** key:
  - Interrupt input
  - Jump to next higher menu

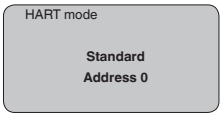
Adjustment system

The sensor is adjusted via the four keys of the display and adjustment module. The LC display indicates the individual menu items. The functions of the individual keys are shown in the above illustration. Approx. 10 minutes after the last pressing of a key, an automatic reset to measured value indication is triggered. Any values not confirmed with ***[OK]*** will not be saved.

6.4 Setup steps

Address setting HART multidrop

In HART-Multidrop mode (several sensors on one input) the address must be set before continuing with the parameter adjustment. You will find a detailed description in the operating instructions manual "*Display and adjustment module*" or in the online help of PACTware or DTM.



Parameter adjustment

As VEGAPULS 65 is a distance measuring instrument, the distance from the sensor to the product surface is measured. To have the real product level displayed, an allocation of the measured distance to the percentage height must be made. To carry out this adjustment, the distance is entered with full and empty vessel. If these values are not known, an adjustment with the distance values, e.g. 10 % and 90 % is also possible. Starting point for these distance specifications is always the seal surface of the thread or flange. With these settings, the real level is calculated. Furthermore the operating range of the sensor is limited from maximum to the required range.

The real product level during this adjustment is not important, because the min./max. adjustment is always carried out without changing the product level. These settings can be made ahead of time without the instrument having to be installed.

Caution:
If there is a separation of liquids with different dielectric constant in the vessel, e.g. from condensation, VEGAPULS 65 can detect under certain circumstances only the medium with the higher dielectric constant.

Keep in mind that interfaces can cause faulty measurements.

If you want to measure the total height of both liquids reliably, please contact our service department or use an instrument specially designed for interface measurement.

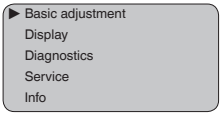
In the main menu item "*Basic adjustment*", the individual submenu items should be selected one after the other and provided with the correct parameter values.

Start your parameter adjustment with the following menu items of the basic adjustment:

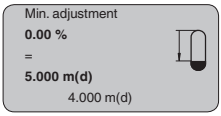
Carry out min. adjustment

Proceed as follows:

1. Move from the measured value display to the main menu by pushing ***[OK]***.



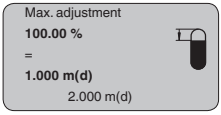
2. Select the menu item "*Basic adjustment*" with ***[->]*** and confirm with ***[OK]***. Now the menu item "*Min. adjustment*" is displayed.



3. Prepare the % value for editing with ***[OK]*** and set the cursor to the requested position with ***[->]***. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the distance value.
4. Enter the suitable distance value in m for the empty vessel (e.g. distance from the sensor to the vessel bottom) corresponding to the percentage value.
5. Save the settings with ***[OK]*** and move to "Max. adjustment" with ***[->]***.

Carry out max. adjustment

Proceed as follows:

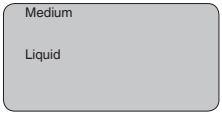


1. Prepare the % value for editing with ***[OK]*** and set the cursor to the requested position with ***[->]***. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the distance value.

2. Enter the appropriate distance value in m (corresponding to the percentage value) for the full vessel. Keep in mind that the max. level must lie below the dead band.
3. Save the settings with ***[OK]*** and move to "Medium selection" with ***[->]***.

Medium selection

Each product has different reflective properties. In addition, there are various interfering factors which have to be taken into account: agitated product surfaces and foam generation (with liquids); dust generation, material cones and echoes from the vessel wall (with solids). To adapt the sensor to these different conditions, you should first select "*Liquid*" or "*Solid*".



According to the conductivity and the dielectric constant of liquids, the reflection properties can differ considerably. Therefore additional options such as "*Solvent*", "*Chem. mixture*" and "*Water based*" are offered below the menu item Liquid.

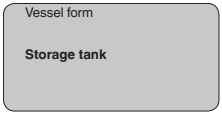
With solids, you can also choose between "*Powder/Dust*", "*Granular/Pellets*" or "*Ballast/Pebbels*".

Through this additional selection, the sensor is adapted perfectly to the product and measurement reliability, particularly in products with poor reflective properties, is considerably increased.

Enter the requested parameters via the appropriate keys, save your settings and jump to the next menu item with the ***[->]*** key.

Vessel form

Apart from the medium, the vessel shape can also influence the measurement. To adapt the sensor to these measuring conditions, this menu item offers different options depending on whether liquid or bulk solid is selected. With "*Liquids*" these are "*Storage tank*", "*Stilling tube*","*Open vessel*" or "*Stirred vessel*", with "*Solid*", "*Silo*" or "*Bunker*".

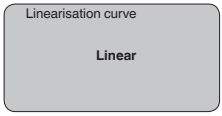


Enter the requested parameters via the appropriate keys, save your settings and jump to the next menu item with the ***[->]*** key.

Linearisation curve

A linearisation is necessary for all vessels in which the vessel volume does not increase linearly with the level - e.g. in a horizontal cylindrical or spherical tank - and the indication or output of the volume is required. Corresponding linearisation curves are preprogrammed for these vessels. They represent the correlation between the level percentage and vessel volume. By activating the appropriate curve, the volume percentage of the vessel is displayed correctly. If the volume

should not be displayed in percent but e.g. in l or kg, a scaling can be also set in the menu item "*Display*".



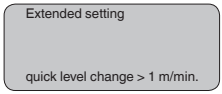
Enter the requested parameters via the appropriate keys, save your settings and jump to the next menu item with the ***[->]*** key.

Caution:
Note the following if the VEGAPULS 65 with corresponding approval is used as part of an overfill protection system according to WHG (Water Resources Act):

If a linearisation curve is selected, the measuring signal is no longer necessarily linear to the filling height. This must be considered by the user especially when adjusting the switching point on the limit signal transmitter.

Extended setting/Quick level change

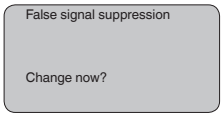
The menu item "*Extended setting*" offers the possibility to optimise VEGAPULS 65 for applications in which the level changes very quickly. To do this, select the function "*Quick level change > 1 m/min.*".



Note:
Since with the function "*Quick level change > 1 m/min.*" the generation of an average value of the signal processing is considerably reduced, false reflections by agitators or vessel installations can cause measured value fluctuations. A false echo memory is thus recommended.

False signal suppression

High sockets or vessel installations, such as e. g. struts or agitators as well as buildup and weld joints on the vessel walls, cause interfering reflections which can impair the measurement. A false echo storage detects and marks these false echoes, so that they are no longer taken into account for the level measurement. A false echo memory should be created with low level so that all potential interfering reflections can be detected.



Proceed as follows:

1. Move from the measured value display to the main menu by pushing ***[OK]***.
2. Select the menu item "*Service*" with ***[->]*** and confirm with ***[OK]***. Now the menu item "*False signal suppression*" is displayed.

3. Confirm "*False signal suppression - Change now*" with ***[OK]*** and select in the below menu "*Create new*". Enter the actual distance from the sensor to the product surface. All false signals in this area are detected by the sensor and saved after confirming with ***[OK]***.

Note:
Check the distance to the product surface, because if an incorrect (too large) value is entered, the existing level will be saved as a false signal. The level would then no longer be detectable in this area.

Copy sensor data

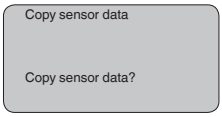
This function enables reading out parameter adjustment data as well as writing parameter adjustment data into the sensor via the display and adjustment module. A description of the function is available in the operating instructions manual "*Display and adjustment module*".

The following data are read out or written with this function:

- Measured value presentation
- Adjustment
- Medium
- Inner diameter of the standpipe (with standpipe versions)
- Vessel form
- Damping
- Linearisation curve
- Sensor-TAG
- Displayed value
- Display unit
- Scaling
- Current output
- Unit of measurement
- Language

The following safety-relevant data are **not** read out or written:

- HART mode
- PIN
- SIL



Reset

Basic adjustment
If the "*Reset*" is carried out, the sensor resets the values of the following menu items to the reset values (see chart):[1)]

Menu item	Reset value
Max. adjustment	0 m(d)
Min. adjustment	Meas. range end in m(d)[2)]
Medium	Liquid

[1)] Sensor-specific basic adjustment.
[2)] Depending on the sensor type, see chapter "Technical data".

Menu item	Reset value
Vessel form	not known
Damping	0 s
Linearization	Linear
Sensor-TAG	Sensor
Displayed value	Distance
Extended settings	None
Current output - characteristics	4 … 20 mA
Current output - max. current	20 mA
Current output - min. current	4 mA
Current output - failure	< 3.6 mA
Unit of measurement	m(d)

The values of the following menu items are *not* reset to the reset values (see chart) with "**Reset**":

Menu item	Reset value
Backlight	No reset
Language	No reset
SIL	No reset
HART mode	No reset

Default setting
Like basic adjustment, but in addition, special parameters are reset to default values.[3)]

Peak value indicator
The min. and max. distance values are reset to the actual value.

Optional settings

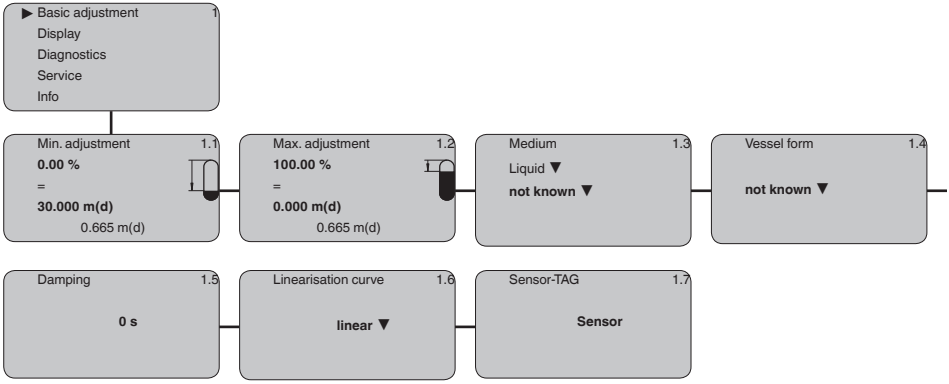
Additional adjustment and diagnosis options such as e.g. scaling, simulation or trend curve presentation are shown in the following menu schematic. You will find a detailed description of these menu items in the operating instructions manual "*Display and adjustment module*".

6.5 Menu schematic

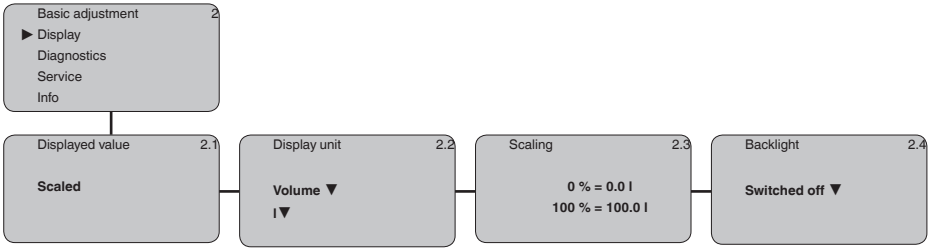
Information:
Depending on the version and application, the light-coloured menu windows are not always available or offer nor selection possibility.

[3)] Special parameters are parameters which are set customer-specifically on the service level with the adjustment software PACTware.

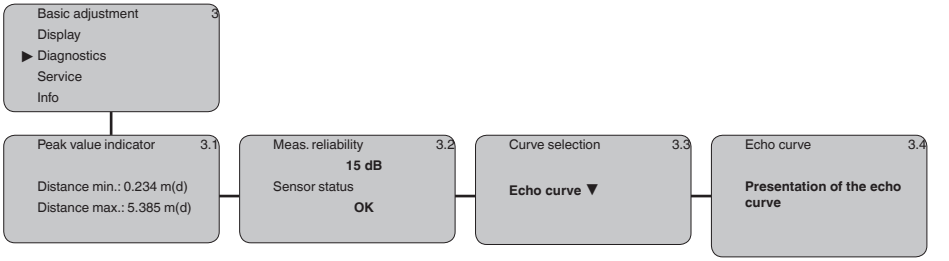
Basic adjustment



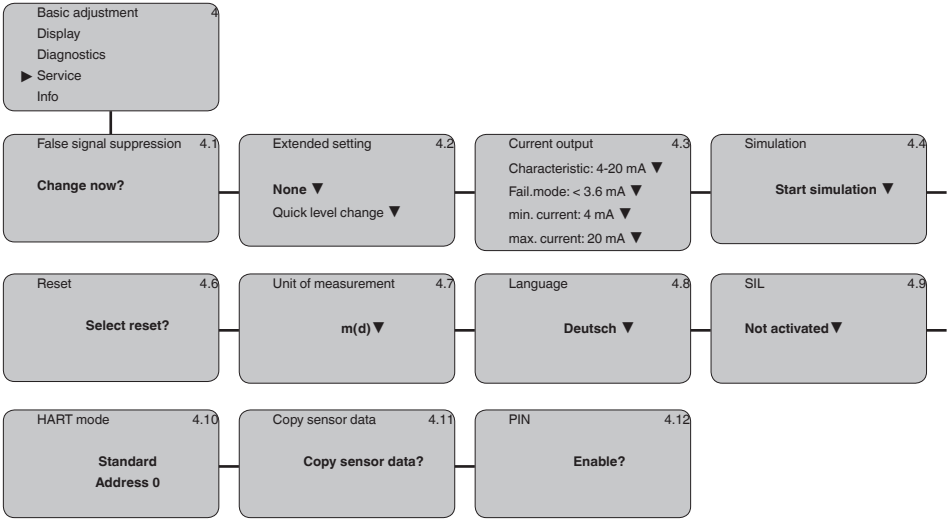
Display



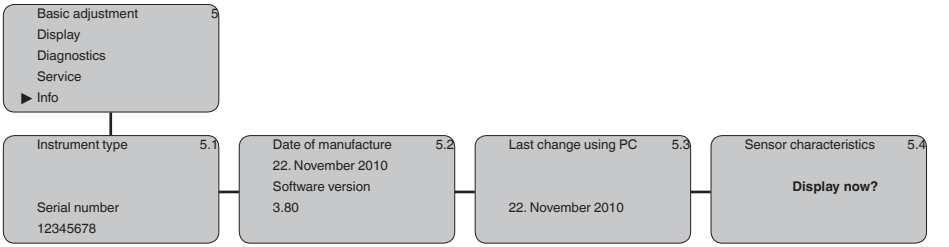
Diagnostics



Service



Info



6.10 Saving the parameter adjustment data

We recommended noting the adjusted data, e.g. in this operating instructions manual, and archiving them afterwards. They are thus available for multiple use or service purposes.

If VEGAPULS 65 is equipped with a display and adjustment module, the most important data can be read out of the sensor into the display and adjustment module. The procedure is described in the operating instructions manual "*Display and adjustment module*" in the menu item "*Copy sensor data*". The data remain there permanently even if the sensor power supply fails.

If it is necessary to exchange the sensor, the display and adjustment module is inserted into the replacement instrument and the data are written into the sensor under the menu item "*Copy sensor data*".

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7 Set up with PACTware and other adjustment programs

7.1 Connect the PC

VEGACONNECT directly on the sensor

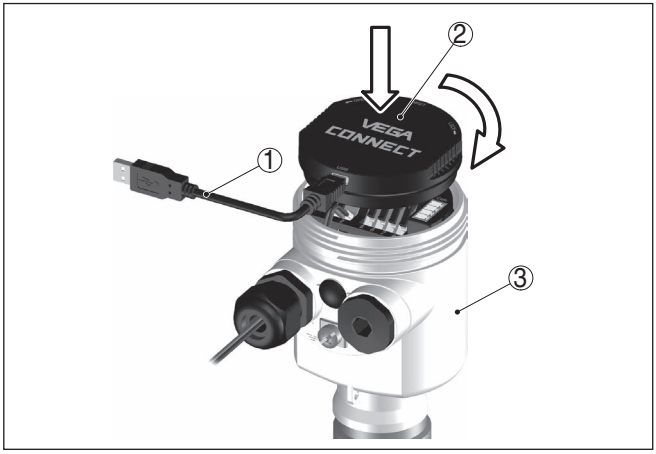

Fig. 27: Connection of the PC via VEGACONNECT directly to the sensor

1 USB cable to the PC
2 VEGACONNECT
3 Sensor

VEGACONNECT externally

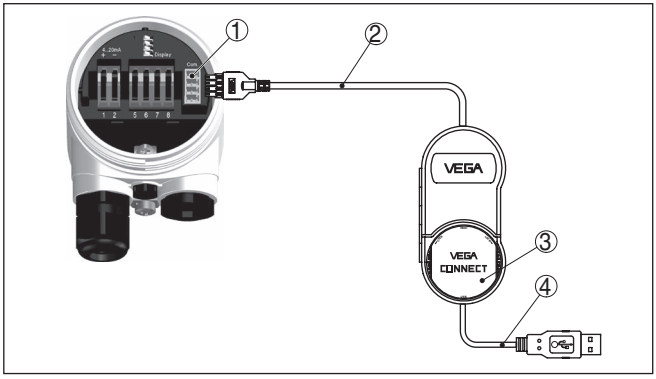

Fig. 28: Connection via VEGACONNECT externally

1 I^2C bus (com.) interface on the sensor
2 I^2C connection cable of VEGACONNECT
3 VEGACONNECT
4 USB cable to the PC

Necessary components:

- VEGAPULS 65
- PC with PACTware and suitable VEGA DTM

- VEGACONNECT
- Power supply unit or processing system

VEGACONNECT via HART

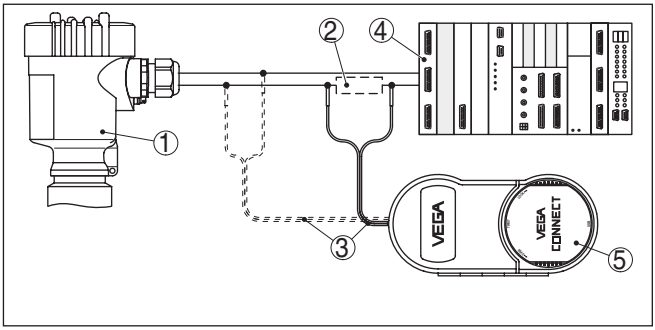

Fig. 29: Connecting the PC via HART to the signal cable

1 VEGAPULS 65
2 HART resistance 250 Ω (optional depending on processing)
3 Connection cable with 2 mm pins and terminals
4 Processing system/PLC/Voltage supply

Necessary components:

- VEGAPULS 65
- PC with PACTware and suitable VEGA DTM
- VEGACONNECT
- HART resistance approx. 250 Ω
- Power supply unit or processing system

Note:
With power supply units with integrated HART resistance (internal resistance approx. 250 Ω), an additional external resistance is not necessary. This applies, e. g. to the VEGA instruments VEGATRENN 149A, VEGADIS 371, VEGAMET 381. Common Ex separators are also usually equipped with a sufficient current limitation resistance. In such cases, VEGACONNECT 4 can be connected parallel to the 4 … 20 mA cable.

7.2 Parameter adjustment with PACTware

Prerequisites

For parameter adjustment of the instrument via a Windows PC, the configuration software PACTware and a suitable instrument driver (DTM) according to FDT standard are required. The latest PACTware version as well as all available DTMs are compiled in a DTM Collection. The DTMs can also be integrated into other frame applications according to FDT standard.

Note:
To ensure that all instrument functions are supported, you should always use the latest DTM Collection. Furthermore, not all described functions are included in older firmware versions. You can download the latest instrument software from our homepage. A description of the update procedure is also available in the Internet.

Further setup steps are described in the operating instructions manual "*DTM Collection/PACTware*" attached to each DTM Collection and which can also be downloaded from the Internet. Detailed descriptions are available in the online help of PACTware and the DTMs.

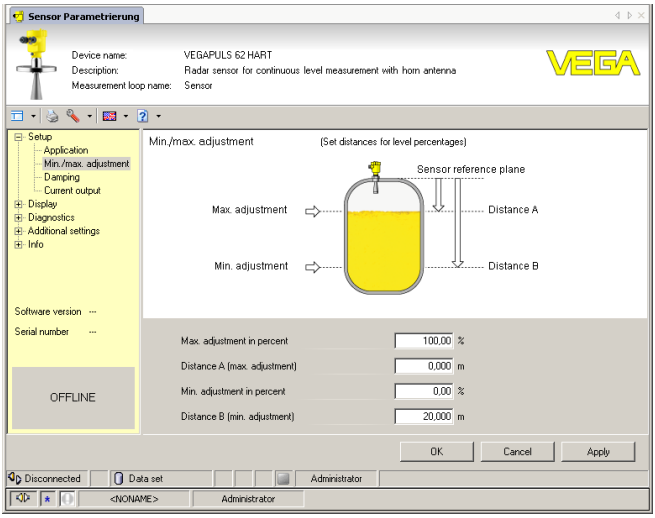

Fig. 30: Example of a DTM view

Standard/Full version

All device DTMs are available as a free-of-charge standard version and as a full version that must be purchased. In the standard version, all functions for complete setup are already included. An assistant for simple project configuration simplifies the adjustment considerably. Saving/printing the project as well as import/export functions are also part of the standard version.

In the full version there is also an extended print function for complete project documentation as well as a save function for measured value and echo curves. In addition, there is a tank calculation program as well as a multiviewer for display and analysis of the saved measured value and echo curves.

The standard version is available as a download under www.vega.com/downloads and "*Software*". The full version is available on CD from the agency serving you.

7.3 Parameter adjustment with AMS™ and PDM

For VEGA sensors, instrument descriptions for the adjustment programs AMS™ and PDM are available as DD or EDD. The instrument descriptions are already implemented in the current versions of AMS™ and PDM.

For older versions of AMS™ and PDM, a free-of-charge download is available via Internet. Move via www.vega.com and "*Downloads*" to "*Software*".

7.4 Saving the parameter adjustment data

It is recommended to document or save the parameter adjustment data. That way they are available for multiple use or service purposes.

The VEGA DTM Collection and PACTware in the licensed, professional version provide suitable tools for systematic project documentation and storage.

8 Maintenance and fault rectification

8.1 Maintenance

If the instrument is used properly, no special maintenance is required in normal operation.

8.2 Rectify faults

Reaction when malfunctions occur

The operator of the system is responsible for taking suitable measures to rectify faults.

Causes of malfunction

VEGAPULS 65 offers maximum reliability. Nevertheless, faults can occur during operation. These may be caused by the following, e.g.:

- Sensor
- Process
- Voltage supply
- Signal processing

Fault rectification

The first measures to be taken are to check the output signals as well as to evaluate the error messages via the display and adjustment module. The procedure is described below. Further comprehensive diagnostics can be carried out on a PC with the software PACTware and the suitable DTM. In many cases, the causes can be determined and the faults rectified this way.

24 hour service hotline

Should these measures not be successful, please call in urgent cases the VEGA service hotline under the phone no. **+49 1805 858550**.

The hotline is manned 7 days a week round-the-clock. Since we offer this service worldwide, the support is only available in the English language. The service is free, only standard call charges are incurred.

Check the 4 … 20 mA signal

Connect a multimeter in the suitable measuring range according to the wiring plan. The following table describes possible errors in the current signal and helps to remove them:

Error	Cause	Rectification
4 … 20 mA signal not stable	Level fluctuations	Set damping via the display and adjustment module
4 … 20 mA signal missing	Electrical connection faulty	Check connection according to chapter "*Connection steps*" and if necessary, correct according to chapter "*Wiring plan*"
	Voltage supply missing	Check cables for breaks; repair if necessary
	Operating voltage too low or load resistance too high	Check, adapt if necessary
Current signal greater than 22 mA or less than 3.6 mA	Electronics module in the sensor defective	Exchange the instrument or send it in for repair

In Ex applications, the regulations for the wiring of intrinsically safe circuits must be observed.

Error messages via the display and adjustment module

Error code	Cause	Rectification
E013	no measured value available	– Sensor in boot phase – Sensor does not find an echo, e.g. due to faulty installation or wrong parameter adjustment
E017	Adjustment span too small	– Carry out a fresh adjustment and increase the distance between min. and max. adjustment
E036	no operable sensor software	– Carry out a software update or send instrument for repair
E041, E042, E043	Hardware error, electronics defective	– Exchange the instrument or send it in for repair

Reaction after fault rectification

Depending on the reason for the fault and the measures taken, the steps described in chapter "*Set up*" may have to be carried out again.

8.3 Exchanging the electronics module

If the electronics module is defective, it can be replaced by the user.

In Ex applications, only instruments and electronics modules with appropriate Ex approval may be used.

If there is no electronics module available on site, one can be ordered from the VEGA agency serving you.

Sensor serial number

The new electronics module must be loaded with the settings of the sensor. These are the options:

- At the factory by VEGA
- Or on site by the user

In both cases, the sensor serial number is necessary. The serial numbers are stated on the type label of the instrument, inside the housing or on the delivery note.

Information:
When loading on site, first of all the order data must be downloaded from the Internet (see operating instructions manual "*Electronics module*").

Assignment

The electronics modules are adapted to the respective sensor and distinguish also in the signal output or power supply.

8.4 Software update

The software version of VEGAPULS 65 can be determined as follows:

- on the type label of the electronics
- Via the display and adjustment module
- via PACTware

You can view all software histories on our website www.vega.com. Make use of this advantage and get registered for update information via e-mail.

The following components are required to update the sensor software:

- Sensor
- Voltage supply
- VEGACONNECT
- PC with PACTware
- Current sensor software as file

Load sensor software to PC

At "www.vega.com/downloads" go to "*Software*". Select under "*plics sensors and instruments*", "*Firmware updates*" the respective instrument series and software version. Load the zip file via the right mouse key with "*Save target as*" e.g. on the desktop of your PC. Move with the right mouse key to the folder and select "*Extract all*". Save the extracted files, for example on the desktop.

Prepare update

Connect the signal conditioning instrument to power supply and provide the connection from the PC to the instrument via the interface adapter. Start PACTware and go via the menu "*Project*" to the *VEGA project assistant*. Select "*USB*" and "*Set instruments online*". Activate the project assistant with "*Start*". The assistant establishes the connection automatically and opens the parameter adjustment window "*Sensor # online parameter adjustment*". Connect this parameter adjustment window before you carry out further steps.

Load software into sensor

Select with the right mouse key the sensor in the project and go to "*Additional function*". Then click to "*Software update*". The window "*Sensor # software update*" opens. PACTware checks now the sensor data and displays the actual hardware and software version of the sensor. This takes approximately 60 s.

Push the button "*Update software*" and select the previously extracted hex file. Then the software update can be started. The additional files are installed automatically. Depending on the sensor, this procedure can last up to 1 h. Then the message appears ""*Software update successfully executed*".

8.5 How to proceed if a repair is needed

You can find a repair form as well as detailed information on how to proceed at www.vega.com/downloads and "*Forms and certificates*".

By doing this you help us carry out the repair quickly and without having to call back for needed information.

If a repair is necessary, please proceed as follows:

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and, if need be, also a safety data sheet outside on the packaging

- Please contact the agency serving you to get the address for the return shipment. You can find the agency on our home page www.vega.com.

9 Dismount

9.1 Dismounting steps

Warning:
Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel or pipeline, high temperatures, corrosive or toxic products etc.

Take note of chapters "*Mounting*" and "*Connecting to power supply*" and carry out the listed steps in reverse order.

9.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the parts to be easily separable.

WEEE directive 2002/96/EG
This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws. Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

Correct disposal avoids negative effects on humans and the environment and ensures recycling of useful raw materials.

Materials: see chapter "*Technical data*"

If you have no way to dispose of the old instrument properly, please contact us concerning return and disposal.

10 Supplement

10.1 Technical data

General data	
316L corresponds to 1.4404 or 1.4435	
Materials, wetted parts	
– Process fitting - thread	PVDF, 316L
– Seal - thread PVDF	FKM (Viton)
– Seal - thread 316L	Klingersil C-4400
– Process fittings Tri-Clamp and slotted nut	316L
– Process fitting - flange	Flange plating PTFE
– Antenna for sockets 50 mm (1.969 in)	PVDF, PTFE
– Antenna for sockets 100 mm (3.937 in) and 250 mm (9.843 in)	PTFE
Materials, non-wetted parts	
– Housing	Plastic PBT (polyester), Alu die-casting, powder-coated, 316L
– Seal between housing and housing cover	NBR (Alu/stainless steel housing), silicone (plastic housing)
– Inspection window in housing cover for PLICSCOM	Polycarbonate (UL-746-C listed)
– Ground terminal	316Ti/316L
Ohmic contact	Zwischen Erdungsklemme und metallischem Prozessanschluss
Torque of the flange screws (min.)	60 Nm (44.25 lbf ft)
Weight	
– Process fitting - thread, depending on thread size and housing material	2 … 2.8 kg (4.409 … 6.173 lbs)
– Process fitting - flange, depending on flange size and housing material	4.2 … 15.4 kg (9.259 … 33.95 lbs)

Output variable	
Output signal	4 … 20 mA/HART
Cycle time	min. 1 s (dependent on the parameter setting)
Signal resolution	1.6 µA
Failure signal current output (adjustable)	mA value unchanged 20.5 mA, 22 mA, < 3.6 mA (adjustable)
Max. output current	22 mA
Load	see load diagram under Power supply
Damping (63 % of the input variable)	0 … 999 s, adjustable
Met NAMUR recommendation	NE 43

HART output values	
– 1. HART value (Primary Value)	Distance to the level
– 2. HART value (Secondary Value)	Distance to the level - scaled (for example hl, %)
Resolution, digital	> 1 mm (0.039 in)

Input variable	
Measured variable	distance between process fitting and product surface
Min. distance from antenna end	50 mm (1.969 in)
Measuring range	up to 30 m (98.43 ft)

Reference conditions to measuring accuracy (according to DIN EN 60770-1)	
Reference conditions according to DIN EN 61298-1	
– Temperature	+18 … +30 °C (+64 … +86 °F)
– Relative humidity	45 … 75 %
– Air pressure	860 … 1060 mbar/86 … 106 kPa (12.5 … 15.4 psig)
Other reference conditions	
– Reflector	ideal reflector, e.g. metal plate 2 x 2 m
– False reflections	Biggest false signal, 20 dB smaller than the useful signal

Characteristics and performance data	
Measuring frequency	C-band (6 GHz technology)
Beam angle -3 dB	24°
Step response or adjustment time[4)]	> 1 s (dependent on the parameter setting)
Max. level change	adjustable up to 1 m/min. (dependent on the parameter adjustment)
Max. emitted HF power of the antenna system	
– Pulse peak power approx.	0.1 mW
– Pulse duration	< 2 ns
– SAR value[5)]	0.471 mW/kg

Measuring accuracy	
Resolution, general	max. 1 mm (0.039 in)
Deviation[6)]	see diagrams

[4)] Time to output the correct level (with max. 10 % deviation) after a sudden level change.
[5)] at the aperture of a horn antenna with ø 150 mm
[6)] Incl. non-linearity, hysteresis and non-repeatability.

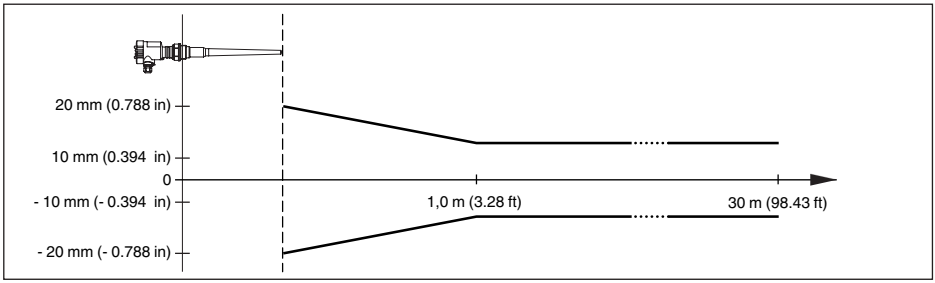

Fig. 31: Deviation VEGAPULS 65

Influence of the ambient temperature to the sensor electronics[7)]

Average temperature coefficient of the zero signal (temperature error) 0.03 %/10 K

Influence of the superimposed gas and pressure to the accuracy

The spreading speed of the radar impulses in gas or vapour above the product is reduced by high pressures. This effect depends on the superimposed gas or vapour and increases with low temperatures. The following chart shows the deviation caused by some typical gases or vapours. The stated values refer to the distance. Positive values mean that the measured distance is too high, negative values that the measured distance is too small.

Gas phase	Temperature	1 bar/14.5 psig	10 bar/145 psig	50 bar/725 psig
Air/Nitrogen	20 °C/68 °F	0.00 %	0.22 %	1.2 %
Air/Nitrogen	200 °C/392 °F	0.00 %	0.13 %	0.74 %
Hydrogen	20 °C/68 °F	-0.01 %	0.10 %	0.61 %
Hydrogen	200 °C/392 °F	-0.02 %	0.05 %	0.37 %
Water (saturated steam)	100 °C/212 °F	0.20 %	-	-
Water (saturated steam)	180 °C/356 °F	-	2.1 %	-

Ambient conditions

Ambient, storage and transport temperature -40 … +80 °C (-40 … +176 °F)

Process conditions

For the vessel pressure, you also have to note the specifications on the type label. Always the lowest value is applicable.

Vessel pressure

- Screwed part PVDF -100 … 300 kPa/-1 … 3 bar (-14.5 … 43.5 psig)
- Screwed part and flange 316L -100 … 1600 kPa/-1 … 16 bar (-14.5 … 232 psig)

[7)] Relating to the nominal measuring range, in the temperature range -40 … +80 °C .

Process temperature (measured on the process fitting)	
– Process fitting, thread PVDF	-40 … +130 °C (-40 … +266 °F)
– Other process fittings	-40 … +150 °C (-40 … +302 °F)
Vibration resistance	mechanical vibrations with 4 g and 5 … 100 Hz[8]

Electromechanical data - version IP 66/IP 67 and IP 66/IP 68; 0.2 bar

Cable entry/plug[9]	
– Single chamber housing	– 1 x cable gland M20 x 1.5 (cable: ø 5 … 9 mm), 1 x blind plug M20 x 1.5 or: – 1 x closing cap M20 x 1.5; 1 x blind plug M20 x 1.5 or: – 1 x closing cap ½ NPT, 1 x blind plug ½ NPT or: – 1 x plug (depending on the version), 1 x blind stopper M20 x 1.5
– Double chamber housing	– 1 x cable entry M20 x 1.5 (cable: ø 5 … 9 mm), 1 x blind plug M20 x 1.5; 1 x blind plug M16 x 1.5 or optionally available with 1 x plug M12 x 1 for external display and adjustment unit or: – 1 x closing cap ½ NPT, 1 x blind plug ½ NPT, 1 x blind plug M16 x 1.5 or optionally 1 x plug M12 x 1 for external display and adjustment unit or: – 1 x plug (depending on the version), 1 x blind plug M20 x 1.5; 1 x blind plug M16 x 1.5 or optionally available with 1 x plug M12 x 1 for external display and adjustment unit
Spring-loaded terminals for wire cross-section	< 2.5 mm² (AWG 14)

Electromechanical data - version IP 66/IP 68 (1 bar)

Cable entry	
– Single chamber housing	1 x IP 68 cable gland M20 x 1.5; 1 x blind plug M20 x 1.5
– Double chamber housing	1 x IP 68 cable gland M20 x 1.5; 1 x blind stopper M20 x 1.5; 1 x blind stopper M16 x 1.5
Connection cable	
– Wire cross-section	0.5 mm² (AWG 20)
– Wire resistance	< 0.036 Ω/m (0.011 Ω/ft)
– Tensile strength	< 1200 N (270 lbf)
– Standard length	5 m (16.4 ft)
– Max. length	1000 m (3280 ft)

[8] Tested according to the guidelines of German Lloyd, GL directive 2.
[9] Depending on the version M12 x 1, according to DIN 43650, Harting, 7/8" FF.

– Min. bending radius	25 mm (0.984 in) with 25 °C (77 °F)
– Diameter approx.	8 mm (0.315 in)
– Colour - standard PE	Black
– Colour - standard PUR	Blue
– Colour - Ex-version	Blue

Display and adjustment module

Voltage supply and data transmission	through the sensor
Indication	LC display in dot matrix
Adjustment elements	4 keys
Protection rating	
– unassembled	IP 20
– mounted into the sensor without cover	IP 40
Material	
– Housing	ABS
– Inspection window	Polyester foil

Voltage supply

Operating voltage U_B	
– Non-Ex instrument	14 … 36 V DC
– EEx-ia instrument	14 … 30 V DC
– EEx-d-ia instrument	20 … 36 V DC
Operating voltage U_B - illuminated display and adjustment module	
– Non-Ex instrument	20 … 36 V DC
– EEx-ia instrument	20 … 30 V DC
– EEx-d-ia instrument	20 … 36 V DC
Permissible residual ripple	
– < 100 Hz	U_{ss} < 1 V
– 100 Hz … 10 kHz	U_{ss} < 10 mV
Load resistor	
– Calculation	$(U_B - U_{min})/0.022$ A
– Example - Non-Ex instrument with U_B= 24 V DC	(24 V - 14 V)/0.022 A = 455 Ω

Electrical protective measures

Protection, depending on housing version	
– Plastic housing	IP 66/IP 67 (NEMA 4X)
– Aluminium housing, stainless steel housing - investment casting, stainless steel housing - electro-polished	IP 66/IP 68 (0.2 bar) NEMA 6P[10)]

[10)] A suitable cable is the prerequisite for maintaining the protection rating.

– Aluminium and stainless housing, investment casting (optionally available)	IP 66/IP 68 (1 bar) NEMA 6P
Overvoltage category	III
Protection class	II

Functional safety (SIL)

Functional safety is already activated on instruments with SIL qualification ex factory. On instruments without SIL qualification ex factory, the functional safety must be activated by the user via the display and adjustment module or via PACTware for applications according to SIL.

Functional safety according to IEC 61508-4

– Single channel architecture (1oo1D)	up to SIL2
– double channel diversitary redundant architecture (1oo2D)	up to SIL3

You can find detailed information in the supplied Safety Manual of the instrument series or under "www.vega.com", "*Downloads*", "*Approvals*".

Approvals

Instruments with approvals can have different technical specifications depending on the version.

For that reason the associated approval documents of these instruments have to be carefully noted. They are part of the delivery or can be downloaded under www.vega.com via "*VEGA Tools*" and "*Instrument search*" as well as via "*Downloads*" and "*Approvals*".

10.2 Dimensions

Housing in protection IP 66/IP 68 (0.2 bar)

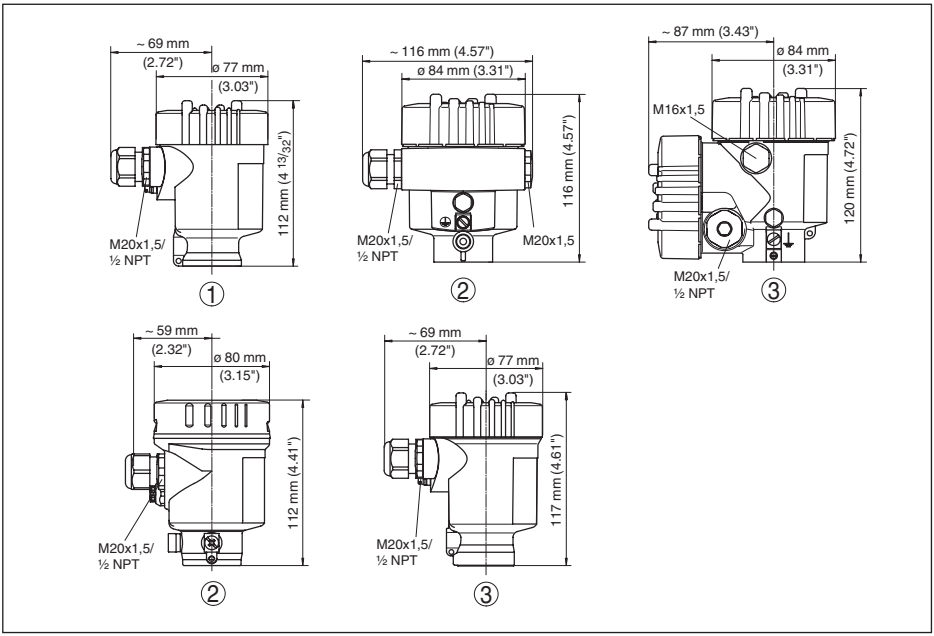

Fig. 32: Housing versions in protection IP 66/IP 68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 *Plastic housing*
2 *Aluminium housing*
3 *Aluminium double chamber housing*
4 *Stainless steel housing, electropolished*
5 *Stainless steel housing - precision casting*

Housing in protection IP 66/IP 68 (1 bar)

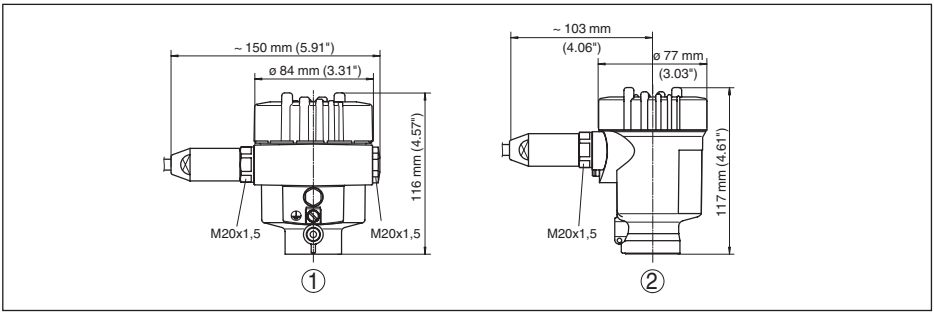

Fig. 33: Housing versions with protection rating IP66/IP68 (1 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Aluminium housing
2 Stainless steel housing - precision casting

VEGAPULS 65, threaded version

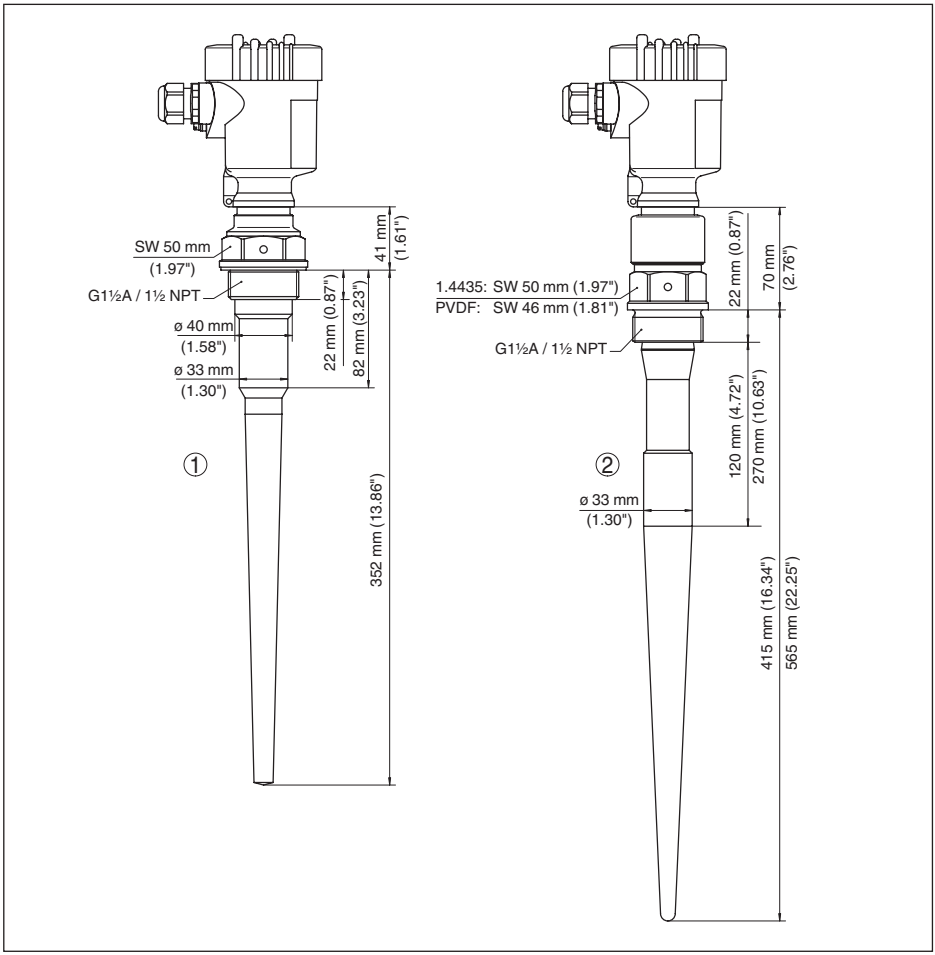

Fig. 34: VEGAPULS 65, threaded version

1 *Thread and hexagon of PVDF for sockets with 50 mm height (inactive length 82 mm, 55/64")*
2 *Thread and hexagon of PVDF or 316L for sockets with 100 mm height (inactive length 120 mm, 4 23/32") or 250 mm height (inactive length 270 mm, 10 5/8")*

VEGAPULS 65, flange version

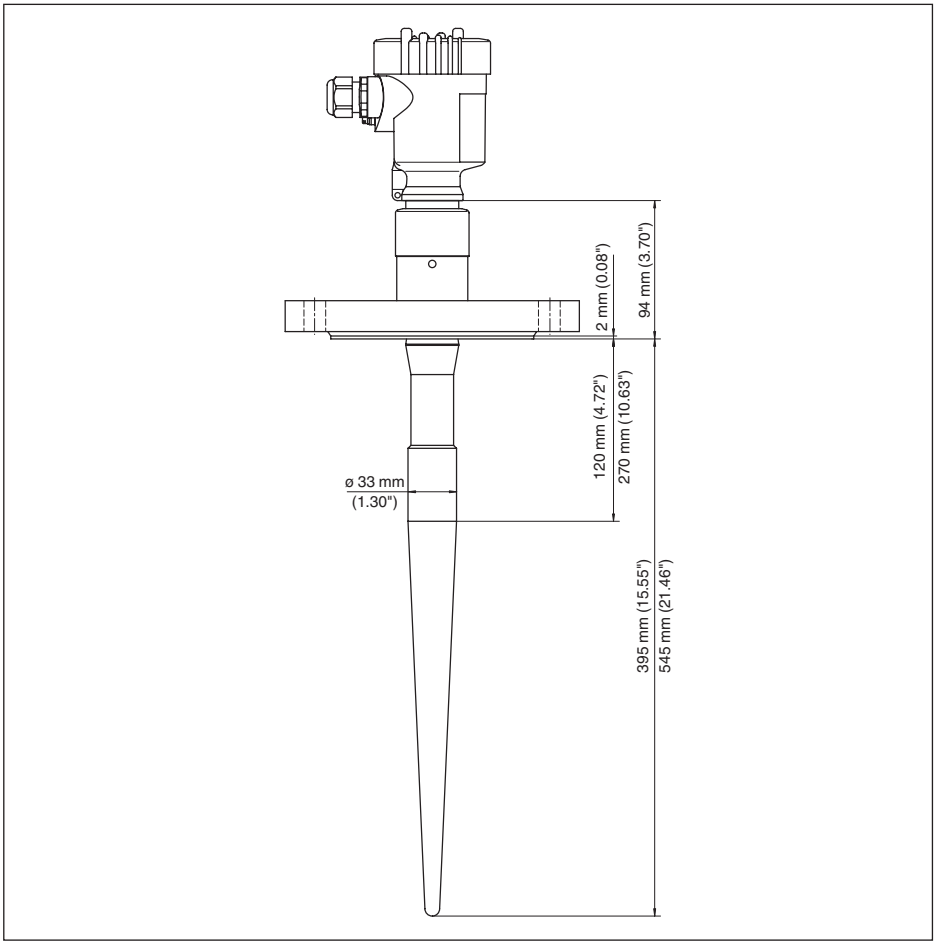

Fig. 35: VEGAPULS 65, flange version for sockets with 100 mm height (inactive length 120 mm, 4 23/32") or 250 mm height (inactive length 270 mm, 10 5/8")

10.3 Industrial property rights

VEGA product lines are global protected by industrial property rights. Further information see www.vega.com.

Only in U.S.A.: Further information see patent label at the sensor housing.

VEGA Produktfamilien sind weltweit geschützt durch gewerbliche Schutzrechte.

Nähere Informationen unter www.vega.com.

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进一步信息请参见网站<www.vega.com。

10.4 Trademark

All the brands as well as trade and company names used are property of their lawful proprietor/ originator.

Printing date:

All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.
Subject to change without prior notice

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VEGA Grieshaber KG
Am Hohenstein 113
77761 Schiltach
Germany

Phone +49 7836 50-0
Fax +49 7836 50-201
E-mail: info.de@vega.com
www.vega.com